(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 976 909 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.02.2000 Bulletin 2000/05

(51) Int Cl.[7]: **E06B 9/72**

(21) Application number: **99830127.9**

(22) Date of filing: **09.03.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **12.03.1998 IT AN980012 U**

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(54) Tubular motor reducer for the handling of winding roller shutters and sunblinds

(57) This invention relates to a tubular motor reducer for the handling of winding roller shutters or sunblinds comprising a mechanic device incorporated in the epicyclic reduction gear (3a,3b,3c) used to prevent motion reversibility.

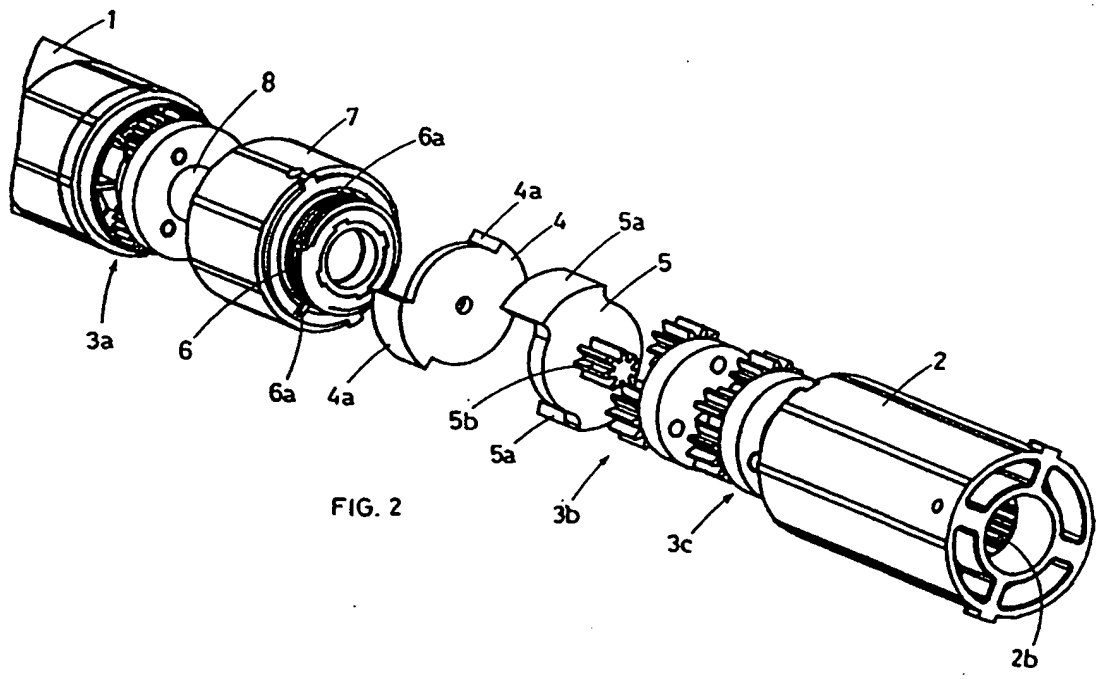

FIG. 2

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Description

[0001] This patent application relates to tubular motor reducer for the handling of winding roller shutters or sunblinds comprising a mechanic device incorporated in the epicyclic reduction gear used to prevent motion reversibility. The device allows the motor reducer to drag the winding element into rotation in both directions and prevents it from moving backwards and dragging the motor shaft into rotation.

[0002] The tubular motor reducer according to the present invention comprises a multi-step epicyclic reduction gear housed in a fixed tubular element whose internal wall features a crown gear on which the crown wheels of the various steps of the epicyclic reduction gear engage. The epicyclic reduction gear is dragged into rotation by an electric motor located outside the tubular element and positioned so that its shaft is coaxially aligned with the tubular element, from whose front end the pin for the power takeoff projects.

[0003] The adapter designed to drag the winding shaft of the roller shutter or sunblind into rotation is splined on the pin.

[0004] Since the motion transmission from the electric motor to the power takeoff pin is not irreversible, this type of tubular motor reducers is always provided with a safety braking system, used to permanently maintain the winding element in upraised position, thus avoiding the risk of accidentally starting the unwanted dangerous down travel of the winding element in an uncontrolled way because of its own weight.

[0005] The most frequently used stop device consists in electromagnetic brakes or, alternatively, mechanical brakes. The mechanical brakes have the advantage of saving the electric power necessary to activate the electromagnetic brakes and having overheating temperatures lower than the temperatures normally reached by electromagnetic brakes in case of prolonged use.

[0006] Instead of the above-mentioned braking systems, some tubular motor reducers for roller shutters or sunblinds feature mechanical devices to make the motion transmission from the electric motor to the power takeoff pin irreversible, so that the power takeoff pin can only be dragged into rotation by the motor reducer, but not by the winding element, whose weight actually generates a twisting moment that discharges on the power takeoff pin.

[0007] The motion irreversibility devices comprise a pair of disks placed side by side that feature two opposed pairs of front teeth that are mutually fixed and engaged so that the first disk can drag the second one with the same transmission mode as in front coupling joints.

[0008] The first disk - that is the disk directly dragged into rotation by the electric motor - is splined at the end of the motor shaft that goes through a cylindrical collar on which a cylindrical elicoidal spring is externally inserted, whose ends are radially bent out and engage from opposed direction one of the front teeth located on the first disk.

[0009] When the first disk is dragged by the electric motor into rotation, the above-mentioned spring is dragged into rotation in the same direction around its centering collar and guide because of the interference between the two bent ends and the disk tooth located between them.

[0010] It must be said that the thrust caused by the tooth on the bent end of the spring determines a stress on the spring itself that tends to enlarge the spring turns, thus practically annulling the friction between the turning spring and its fixed centering collar.

[0011] So, in this case, the spring represents no obstacle to the rotation of the first disk.

[0012] Vice versa, the spring prevents the motion to be transmitted from the second to the first disk, since the opposed pair of front teeth of the second disk engages with the two bent ends of the spring from the outside. In this way the thrust caused by both teeth on the bent end of the spring determines a stress on the spring itself that tends to tighten the spring turns, thus stopping the spring around the centering collar and block of the second disk.

[0013] In view of the above, it must be said that in the current models of tubular motor reducers these mechanical irreversibility devices are always located between the electric motor and the epicyclic reduction gear. This position causes considerable noise of the motor reducer group since the vibrations from the electric motor are amplified first by the irreversibility device and then by the epicyclic reduction gear.

[0014] Another inconvenience is represented by the position of the irreversibility device between motor and reduction gear, resulting in a considerable loss of the motor rated torque.

[0015] The purpose of the present invention is to eliminate both these inconveniences that are typical of a tubular motor reducer for the handling of winding roller shutters and sunblinds.

[0016] This objective has been reached by the present invention thanks to a different position of the irreversibility mechanical device that is assembled inside the epicyclic reduction gear, more exactly after the first step of the epicyclic reduction gear.

[0017] In this way the vibrations transmitted by the motor at the first step of the epicyclic reduction gear are reduced by the irreversibility device itself, thus reducing the noise with respect to the known tubular motor reducers.

[0018] It must also be noted that this position increases the overall yield of the transmission system with an insignificant torque loss.

[0019] For clearer explication purposes, the description of the tubular motor reducer continues with reference to the enclosed drawings whereby:

- Fig. 1 is an exploded lateral view of the various components of the tubular motor reducer according to

the present invention;

- Fig. 2 is an exploded axonometric view of the irreversibility mechanical device positioned after the first step of a three-step epicyclic reduction gear;
- Fig. 3 is a cross-section of the three-step epicyclic reduction gear with an axial plane incorporating the irreversibility device positioned between the first and the second step.

[0020] With reference to the above mentioned figures, the tubular motor reducer according to the present invention comprises an electric motor (1) able to rotate both clock and counterclockwise located in external coaxial position with respect to a sleeve (2) from which the pin (2a) for the power takeoff of the winding shaft of the roller shutter or sunblind projects.

[0021] The motion transmission from the motor (1) to the power takeoff pin (2a) occurs through an epicyclic reduction gear made up of three successive steps (3a, 3b and 3c) partly housed inside the sleeve (2), whose internal surface features a crown gear (2b) that engages with the crown wheels of the epicyclic reduction gear.

[0022] The tubular motor reducer also includes an irreversibility mechanical device made up of a first disk (4) provided with an opposed pair of front teeth (4a), a second disk (5) also provided with an opposed pair of front teeth (5a) and a cylindrical helical spring (6) whose ends (6a) are drawn closer and radially bent out.

[0023] The two disks (4 and 5) are placed side by side so that the teeth of one disk engage with the teeth of the other disk, with the same type of matching as in front coupling joints. The two engaged pairs of front teeth contain the spring (6) between whose bent ends (6a) one of the teeth (4a) of the first disk (4) is located, while the two teeth (5a) of the second disk (5) are located outside and on opposite sides with respect to the two bent ends (6a) of the spring (6).

[0024] The tubular motor reducer according to the present invention is characterized by the fact that the pair of disks (4 and 5) with the spring (6) is incorporated into the epicyclic reduction gear and more exactly inserted after the first reduction step (3a).

[0025] At this purpose the tubular motor reducer according to the present invention includes a secondary sleeve (7) used to contain the first step (3a) of the epicyclic reduction gear that engages on the opening of the sleeve (2) inside which both the two disks (4 and 5) with spring (6) and the second and third step of the reduction gear are housed.

[0026] The internal wall of the secondary sleeve (7) also features a crown gear (7a) with which the crown wheels of the first step (3a) engage, while the front of the sleeve (7) features the centering collar (7b) of the spring (6).

[0027] The first disk (4) is splined at the end of the shaft (8) coming out of the first step (3a), with the shaft that goes through and comes out of the collar (7b). The second disk (5) features a central pinion (5b) that is used to transmit the motion to the crown wheels of the second step (3b).

[0028] The second disk (5) features a central centering hole on the shaft (8) and is in neutral with respect to the shaft, since the transmission from the shaft (8) to the disk (5) occurs through the disk (4), whose front teeth (4a) drag the front teeth (5a) of the disk (5) into rotation by means of the bent ends (6a) of the spring (6), located between the teeth (4a and 5a) and on which the teeth (4a) directly discharge their thrust.

[0029] Finally it must be said that the external surface of the collar (7b) features some axial grooves (7c) used to contain the necessary quantity of grease to guarantee a continuous effective lubrication of the sliding surface of the spring (6) that - as mentioned before - rotates around the collar (7b).

[0030] The continuous automatic lubrication contributes to an even higher noise reduction in the operation of the motor reducer according to the present invention.

Claims

1. Tubular motor reducer for the handling of roller shutters or sunblinds comprising:

   - an electric motor (1) able to rotate both clock and counterclockwise located in external coaxial position with respect to a sleeve (2) from which the pin (2a) for the power takeoff projects and whose internal surface features a crown gear (2b);
   - a epicyclic reduction gear made up of one or more steps, housed in the sleeve (2), whose crown wheels engage with the crown gear (2b);
   - an irreversibility mechanical device made up of a first disk (4) provided with an opposed pair of front teeth (4a), a second disk (5) also provided with an opposed pair of front teeth (5a) and a cylindrical helical spring (6) whose ends (6a) are drawn closer and radially bent out;

   characterized by the fact that the pair of disks (4 and 5) with the spring (6) is located in the epicyclic reduction gear and more exactly inserted after the first reduction step (3a).

2. Motor reducer according to claim 1, comprising:

   - a secondary sleeve (7) used to contain the first step (3a) of the epicyclic reduction gear that engages on the opening of the sleeve (2) inside which both the pair of disks (4 and 5) with spring (6) and the next reduction steps after the first step; being provided that the internal wall of the secondary sleeve (7) features a crown gear (7a) on which the crown wheels of the first step (3a) engage, while the front of the sleeve (7)

features the centering collar (7b) of the spring (6);

- a first disk (4) that is splined at the end of the shaft (8) coming out of the first step (3a), with the shaft that goes through and comes out of the collar (7a);
- a second disk (5) provided with a central pinion (5b) that transmits the motion to the crown wheels of the second step (3b); being provided that the second disk (5) features a central centering hole on the shaft (8) and is in neutral with respect to the shaft.

3. Motor reducer according to the previous claims, characterized by the fact that the external surface of the collar (7b) features some axial grooves (7c) used to contain the necessary quantity of grease to guarantee a continuous effective lubrication of the sliding surface of the spring (6).

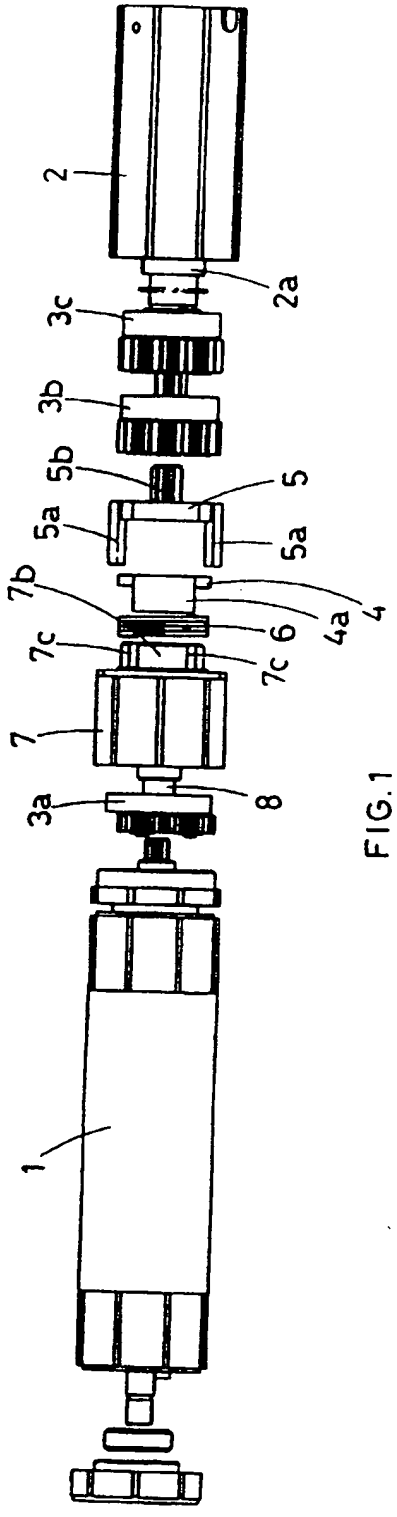

FIG.1

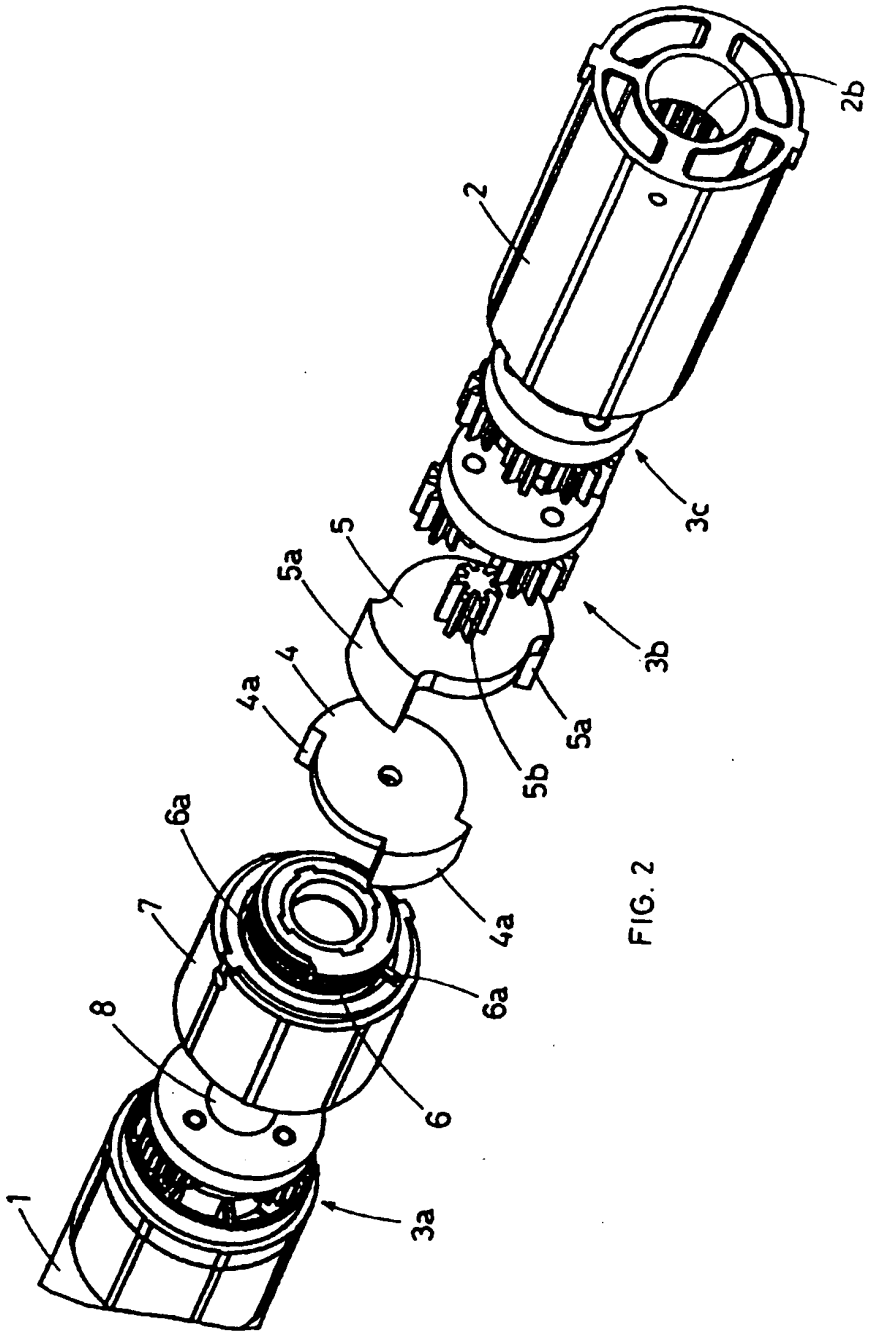

FIG. 2

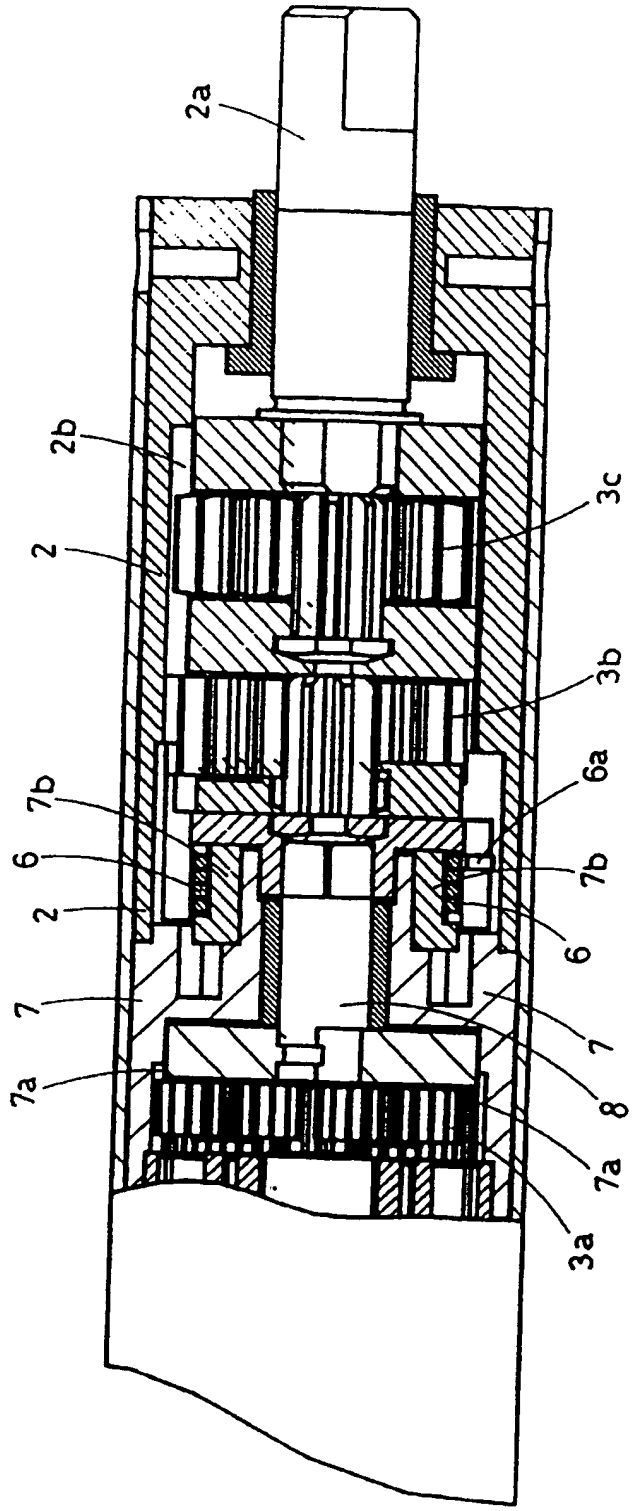

FIG. 3